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ABSTRACT

Ninety-six 9th, 10th, and 11th grade students, randomly selected to include equal numbers from each grade level, from both sexes, and from each ability quartile were randomly assigned to either experimental or control procedures. The experimental group used the computer to select courses, while the control group was assisted by the counselor. Three criterion measures, used to assess the relative effectiveness of the computer-based system, are described: (1) a test of student's understanding of information relevant to course selection; (2) students' self-reported reaction to either the computer or the counselor; and (3) a rating of the completed student programs by 5 counselors. No significant differences are reported. The author acknowledges the impossibility of concluding, from this study, that counselors are more effective than computers in assisting students in the exploration and selection of courses. (Author/TL)

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Computerized Course Exploration and Selection-- A Comparison of the Effectiveness of a Computer-based System with a Counselor-based System[1]

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Abstract

The findings of an experimental study were considered which compared the effectiveness of a computer-based counseling system with a counselor-based system.

During the school year 1970-71, the ninth, tenth, and eleventh grade classes at Willowbrook High School, Villa Park, Illinois used the computer to explore and select courses for the following year. Ninety-six students were randomly selected to include equal numbers from each grade level, from both sexes, and from each ability quartile and were randomly assigned so as to include equal n's to experimental and control procedures. The experimental group used the computer to select courses and the control group was assisted by the counselor in the selection of courses.

Three criterion measures were used to assess the relative effectiveness of the computer-based system: test of students' understanding of information relevant to course selection; students' self-reported reaction to his experience with the computer or counselor; and a rating of the completed student programs by five counselors.

A six-way repeated measures analysis of variance and a four-way completely crossed multivariate analysis of variance was used to interpret the data. Of major concern was the comparison between computer-assisted and counselor-assisted course planning, but the effects of subjects' sex, grade level, and

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ability were also tested as well as all interactions among variables.

No significant differences were found between means of the computer-scheduled students and the counselor-scheduled students across all measures. There were no treatment differences related to ability, sex, and grade based on statistical techniques applied to all of the measures. It is impossible to conclude from this study that counselors are more effective than computers in assisting students in the exploration and selection of courses. A more detailed description of the measures used, data analysis and conclusions are presented in this paper.

Computerized Course Exploration and Selection--
A Comparison of the Effectiveness of a Computer-based System with a Counselor-based System

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A student in high school is asked to make many important decisions regarding the courses he selects. These decisions have a significant effect on later educational and occupational opportunities. In spite of their importance, many of these decisions are made on the basis of inadequate or poorly disseminated information.

Clarke, Gelatt and Levine (1965) pointed out that, "The decision maker needs adequate information, and he needs an effective strategy for analyzing, organizing and synthesizing that information in order to arrive at a choice [p. 41]." Insofar as possible, the high school administration, instructional staff and, in particular, the counselor have a responsibility to disseminate accurate, useable and relevant information with which students can make decisions. Clarke, Gelatt and Levine (1965) summarized the demands placed on the counselor when they stated:

> Greater efforts should be made to determine what specific information is relevant to the educational-vocational decision faced by high school students, to gather and organize that information, and to help students learn to use it effectively [p. 41].

Some of the problems in the current course exploration and selection procedures consist of the shortage of time that counselors have available on the secondary level to assist students in the decision-making process when students need accurate and appropriate information for course exploration and selection. Also, it is sometimes difficult to help students select courses that meet their own needs and interests because of the large number of courses that

are available to the student. Because of time limitations it is extremely difficult in the current situation for counselors to keep up-to-date concerning the current curriculum and what is available to students they counsel.

The movement toward individualized instruction and the rapidly changing curriculum to keep pace with the knowledge explosion are making course selection increasingly difficult. To effectively assist students plan their educational programs, counselors need relevant information about students and about curricular offerings. As courses and programs proliferate to meet individual needs, the information demands become greater. It is quite possible that a computer-based system could provide more accurate information and help students select courses more effectively than counselors. If only as effective as counselors, the computer might be preferred in order to free counselors for other duties.

Purpose

It was the purpose of this study to explore and evaluate the effects of using a computer-based system to assist students in the exploration and selection of courses on the secondary level. The following areas were considered. Is the computer as effective as counselors in assisting students in the decision-making process? Are the decisions made by the student regarding course selection in a computer-based system better than those decisions made by the student in a counselor-based system? Does the effectiveness of a computer-based system or a counselor-based system vary according to the student's grade level, the student's ability or the student's sex?

It was the purpose of this study to evaluate the use of a computer-based system to assist students in the exploration and selection of courses in contrast to a counselor-based system. A unique opportunity to evaluate the relative effectiveness of such a computer system was available when Willowbrook High School initiated such a system for three grade levels during the 1970-71 school year.

Related Research

There are several computer-based systems in guidance and information dissemination. Some of the more recent summaries of the technological aspects of guidance are summarized in Bailey (1970); Havens (1970); Super (1970); Computer-based Vocational Guidance Systems (1969);and Educational Technology (1969).

Of the several computer-based systems that are functioning in some aspect of guidance, some are information storage and retrieval systems (Impellitteri, 1967, 1968). Systems capable of interacting with individual users have been developed for career exploration (Harris, 1968; Impellitteri, 1969; Loughary, et al., 1966; Super, 1968; and Tiedeman, 1968), but there has been very little experimental research of or development of interactive computer-based systems to assist students in course selection. Many writers have indicated that computers could be effectively used in counseling. Cooley (1964) indicated that many of the time-consuming details that take large amounts of the counselor's time can now be automated. One of the time consuming tasks is collecting and distributing accurate and routine information to enable students to select courses. Roberts (1968) stated that the use of technology in guidance would reduce the workload of counselors in the areas of gathering information, data analysis and reporting. Also, the processing of data would improve because of clearer and more accurate communication between the counselor and counselee thru the use of technology. Impellitteri (1967) found a computer-based system to have greater flexibility and storage capacity than counselors and permitted more accurate up-to-date information to be available for the user.

There has been some concern expressed related to the "dehumanizing" process of using man and machine interaction in place of human with human interacting. There is no evidence to suggest that individuals dislike man-machine interaction or that machines cannot do as effective a job as humans.

Impellitteri (1968) summarized the reaction of boys to their interaction with a computerized vocational exploration program The boys in the experimental group did not indicate that the interaction was any problem Many boys indicated they liked the privacy associated with their interaction.

There have been several advantages related to the application of the learning principle to a computer-based model in education. Stewart (1967) found that students benefit in the following areas when using individualized instructional machines:

> (1) Student reinforcement, (2) Student involvement, (3) Item difficulty control, (4) Speed and pattern of response, (5) Peer pressure reduced, (6) Incomplete task apprehension reduced, (7) Culturally fair items--three dimensional items, (8) Single item exposure, and (9) Consistency of administration [pp. 221-23].

The advantages related to reinforcement, student involvement, individualized speed and pattern of responding, reduction of peer pressure, single-small segments of information and a systematic presentation are present in the computer-based program for course exploration and selection Harris (1970) further supported the advantages of computer-based programs when she stated that thru the use of computers and good script writing, technology had a positive effect as a part of the counseling program.

> If you define counseling as bringing a group of related facts to bear upon a given situation and thus facilitating a step-by-step decision-making process, computers can perform this function with maximum speed and efficiency. With good script-writing and adequate inter-change between student and computer, computers can add a dimension of student involvement and excitement to self-appraisal, decision-making, vocation exploration, and educational exploration seldom obtained in traditional counseling conferences [p. 163].

One of the few studies directly relevant to this research was one by Friesen (1965) in which he compared the similarity of outcomes between the computer-based counseling systems, model counselor, and a second counselor. The criteria included pupil appraisal statements and course selections. "The machine agreed with both human counselors on approximately 75 percent of the

appraisal statements and about 65 percent of the course selections." Friesen made three recommendations regarding future studies in computer-based educational exploration: (1) Permit students to explore and select courses that are related to their interests and personality: (2) Check to determine if students have completed the prerequisites before permitting them to enroll in sequential courses; and (3) Do not permit students to sign up for courses that are not related to the student's achievement and aptitude level. All of the above recommendations were included in this study

Methodology

Introduction

During the school year 1970-71, the ninth, tenth, and eleventh grade classes of Willowbrook High School, Villa Park, Illinois used the computer to explore and select courses for the following year. Ninety-six students were randomly chosen in a manner to include equal numbers from each grade level, from both sexes, and from each tested aptitude quartile and were randomly assigned so as to include an equal number of subjects to experimental and to control procedures. The experimental group used the computer-assisted course selection while the control group used the counselor-based system to select courses in the traditional manner.

Three criterion measures were used to assess the relative effectiveness of the computer-based system: test of students' understanding of information relevant to course selection; students' self-reported reaction to his experience with the computer or counselor; and an evaluation of the completed student programs by five counselors who did not know which programs were produced by student-computer interaction and which by student-counselor interaction.

A six-way analysis of variance with repeated measures was used to interpret the data. Each measure had a linear transformation performed on it so

the scores would be comparable across measures. The new score from the linear transformation was formed by dividing each original score on a given measure by the square-root of the mean square error for that measure. Also, a four-way completely crossed multivariate analysis of variance was used to analyze the data. This permitted the investigator to interpret the data from at least two different statistical analyses. Of major concern was the comparison between computer-assisted and counselor-assisted course planning, but the effects of subjects' sex, grade level, and ability were also tested as well as all interactions among variables.

Population

Willowbrook High School is a suburban, comprehensive high school located 15 miles west of Chicago, with approximately 3400 students. After high school, 45% of its students attend four-year colleges; 20% attend the local community college; 25% go directly into jobs without further training; and approximately 10% attend technical and specialized schools.

Sample

The 1970-71 freshman, sophomore, and junior classes were divided into ability quartiles based on their composite grade equivalent score on the SDS Educational Development Series battery. The battery composite was based on eight subscales (non-verbal, verbal, reading, English, math, science, the U.S.A. and solving everyday problems) in four tested areas (Abilities, Language Studies, Technical Studies and Social Studies). From each quartile in each of the three grade levels, two boys and two girls were randomly chosen for each of the two course-selection procedures. The result was a 2 x 3 x 4 x 2 design with two observations randomly assigned to each cell. Thus, there were two treatment groups, three grade levels, four quartiles and two sexes. All of the students in the sample were "computer-wise" due to their experience with vocational

exploration scripts. Each counselor has an IBM 2260 display terminal in his office. It is used on a regular basis during counseling sessions to recall a student's record or explore vocational information with the student.

Measures

Three measures were taken to evaluate the relative effectiveness of the two course exploration and selection procedures.

1. Information Test

   Immediately after the scheduling interview with the counselor or computer, each student was given a test to assess his knowledge of information relevant to making course selections. The test contained items to assess the student's knowledge of curricular offerings, prerequisites, college requirements, etc. This test had a Kuder Richardson #20 reliability of .7463 and a standard error of measurement equal to 1.7982 based on the first trial administration to thirty students. Revisions were made, based on the first administration, to have a more reliable instrument for use in the study. The revised information test had a Kuder Richardson #20 reliability of .7609 and a standard error of measurement equal to 1.9607 when administered to the ninety-six students taking the test in this study.

2. Student Reaction Questionnaire

   Immediately after the scheduling interview with the counselor or computer, each student was asked to report his reaction to the interview. The questionnaire asked students to indicate their degree of satisfaction with the courses selected, with the information provided, and with the way in which information was presented. This questionnaire had a Hoyt reliability of .8395 and a standard error of measurement equal to 4.3638 based on the first trial administration to thirty students. Revisions were made to have a more reliable instrument for

use in the study. The revised questionnaire had a Hoyt reliability of .8504 and a standard error of measurement equal to 3.7363 based on the ninety-six students taking the test in this study.

3. Counselor's Ratings of Course Selections

Twelve counselors from Willowbrook High School independently rated the appropriateness of the course selections for each of the ninety-six students without knowing the identify of the students and without knowing whether the selections were counselor-student or computer-student produced. The raters had aptitude, achievement, interest, and career plan data on each student. For each of these four student characteristics, the raters indicated the appropriateness of the course selections on a five-point scale. Each student's course selection was rated by five different counselors. Each rater had an equal number from each grade level and an equal number of computer-scheduled and counselor-scheduled students to rate. A Hoyt reliability was calculated for all of the ratings on all of the students. A reliability of .6615 and a standard error of measurement of 2.4033 was found for the sum of the counselor ratings. The sum of the ratings for each student was used as a dependent variable in the study.

Treatments

As previously indicated, each subject was randomly assigned to one of the following two treatments in a manner to insure equal call frequency:

1. Computer-Assisted Course Selection

During the first week of February 1971 the students were given a registration guide for them to read before the scheduling interview. The students were then sent a note which indicated that it was time for them to register for their courses for the 1971-72 school year.

The students then made an appointment to be scheduled with the assistance of the computer.

A computer program developed by the initiator of this study and the staff of Willowbrook High School allowed students to interact with the computer to select courses for the following year. The program helped the students consider the curricular alternatives in light of their interests, abilities, and previous course work. Procedures were developed which allowed each student to interact with the program through a visual display terminal. Selection of courses for these students were made without the consultation of a counselor although counselors were available subsequently if the need occurred. After the student selected his courses the secretary checked the student's name against a list to determine if he was in the study. If he was in the study, he was then given the Information Test and the Reaction Questionnaire related to his scheduling interview. No mention was made to the student that this was a part of an experimental study. It was indicated to the student that this was a part of the ongoing evaluation at Willowbrook.

2. Counselor-Assisted Course Selection

Students in this group selected courses in consultation with a counselor in the manner traditionally used at Willowbrook and in many other high schools. The students did not receive computer assistance. During the first week of February 1971 the students were given a registration guide for them to read before the scheduling interview. The students were then sent a note which indicated that it was time for them to register for their courses for the 1971-72 school year. The students then made an appointment to see their counselor to select their courses. The counselors who assisted in scheduling students

did not know which students were in the study and which were not. The student, in an individual interview, talked over his career plans, his academic progress, and his performance on tests he had taken that were assumed to be related to his interests and future plans. This discussion served as the basis for course selection. After the student selected the courses, the course numbers were entered for each student on a computer terminal by the counselor and the student was requested to go to the secretary and pick up a copy of his course selections for the following school year. At this time the secretary checked the student's name against a list to determine if he was in the study. If he was in the study, he was then given the Information Test and the Reaction Questionnaire related to his scheduling interview. No mention was made to the student that this was a part of an experimental study. It was indicated to the student that this was a part of the ongoing evaluation at Willowbrook.

Results

It was of major concern as to whether there would be a difference based on all of the measures between those students scheduled with the assistance of a computer and those students scheduled with the assistance of a counselor. There were no differences between either of the scheduling methods based on the appropriate statistical methods. The means for each of the treatment groups on each of the measures is indicated in Table I.

TABLE I

Treatment Means for Each Measure

Using Transformed Scores*

Variable	Counselors' Rating	Information Test	Students' Reaction	Overall
Control (Counselor Scheduled)	4.4	4.8	8.2	5.8**
Experimental (Computer Scheduled)	4.2	4.9	8.1	5.7**

*See page 8 for explanation of the linear transformation

**Differences among means not significant, p>.05.

The measures had the reliability to detect differences between grades, quartiles and males and females, but no differences were found between the different scheduling methods.

The students were asked to indicate their reaction to each method of scheduling. There were not any differences. The students liked the interacting with the computer as well as they liked interacting with the counselor.

Those students in the upper and lower ability quartiles liked one method as well as the other scheduling method.

One might have suspected differences between the reactions of the boys and the girls to the two course selection methods but there were none.

The counselors rated those courses elected with the aid of a computer as high as those courses elected with the assistance of a counselor in an individual session. Also, the students had equal means on the information test given to them after their scheduling interview with either the computer or the counselor.

Summary

There have been several fears expressed indicating that technology could not be as effective as counselors. Some concerns are: related to the "dehumanizing" process of using man and machine interaction; upper quartile students would get bored; lower quartile students would not understand; and programing could not be individualized. None of these fears seem to be valid based on this study. A variety of independent measures were used in attempting to determine if the results from the two methods of helping students explore and select courses on the secondary level were different.

Because of the efficiency of the computer and the ability to save the counselor time needed to disseminate information about courses, there is no basis for Willowbrook to discontinue using the computer to assist students in the exploration and selection of courses for the following school year.

The implications of this study must be interpreted in terms of the population sampled and the materials employed to measure the differences between treatments. Also, one should consider the measures in terms of their appropriateness to distinguish between those important characteristics related to the desired outcomes for a course exploration and selection method.

It is continuously important, both on a short and long range basis, to evaluate the implications of counseling and its effect on students. It is certainly advisable to consider the role of counselors and how they can be most effective in serving students at the secondary level. With the invention and growth of technology related to counseling it is certainly possible that many of the information disseminating and processing tasks that counselors do could be done more effectively and efficiently by technology. The variables of grade, ability, and sex seem to be important in effecting how decisions are made. The amount of information that one needs at a given time is relative to

his future plans, abilities and achievement.

This study demonstrated that based on the measures used, with the population sampled, that the counselors were no more effective than the computers in assisting the students to explore and select courses on the secondary level for the following school year. It is important to continue to evaluate this process to determine if technology can be as effective as counselors in certain kinds of tasks with certain populations which are currently being done by counselors.

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